University Drive Corridor Improvements

Final Report

November, 2008

University Drive Corridor Improvements

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1.0 Introduction

The University Drive study corridor is a 2,500 foot roadway segment between its intersection with State Route 9, its southern terminus to the intersection with Amity Street south of the University of Massachusetts Campus. The study corridor is a major employment center where land use is characterized by several retail services, restaurants, office buildings, along with an extended care / senior housing development and the US Post Office complex.

Stantec has completed the University Drive Corridor Improvement Study for the Town of Amherst, Massachusetts. This final report illustrates and evaluates two final alternative improvement plans. The final alternatives are briefly described with respect to the three general segments of the corridor as follows:

- A Modified Three-Lane Alternative consisting of:
    - South segment – Modifications to the Route 9 approach and traffic control signal and addition of traffic signal control at the Big Y intersection and the Extended Care driveway on the opposite side of University Drive approximately 150 feet to the north.
    - Middle segment – A series of successive one-way left turn lanes and complementing pedestrian refuge islands within the center lane accommodating two mid block pedestrian crossings.
    - North segment – Modifications to three approaches and legs of the Amity Street intersection and to the traffic control signal.
- A Boulevard with Median Alternative consisting of:
    - South segment – Modifications to the Route 9 approach and traffic control signal and addition of traffic signal control at the Big Y intersection. The Big Y traffic signal could be expanded to include the Extended Care Driveway.
    - Middle segment – Median separation and protected left turn lanes to major corridor trip generators.
    - North segment – Modification to all four approaches of the Amity Street intersection and replacement of traffic signal with roundabout.

1.1 BACKGROUND

The study process leading to this final report began with a less detailed investigation in December, 2003, entitled the University Corridor Study. That study, which has been posted on the Town website, was prepared by Dufresne Henry (merged with Stantec in 2006). In

September, 2005, Dufresne Henry initiated this University Drive Corridor Improvement Study and subsequently submitted a succession of study products:

- Task One Summary: Data Collection and Evaluation of Existing Conditions submitted in March, 2006.
- Task Two Summary: Establishment and Evaluation of Future No-Build Conditions was submitted in memo form to the town in April,2006
- Task Three: Evaluation of Corridor Improvement Alternatives was submitted in the form of an evaluation matrix in May, 2007.

This final report includes the Task Three evaluation matrix and all of the supporting analysis relating to the two final alternatives. This final report references but does not include the Task One and Task Two documentation. Specific traffic circulation patterns relating to each of the final alternatives are represented by weekday morning and evening and Saturday midday peak hour traffic volume networks. Capacity analysis was conducted for the corridor terminal intersections and other major intersections on the corridor using the alternative-specific traffic volume networks.

2.0 Corridor Improvement Alternatives

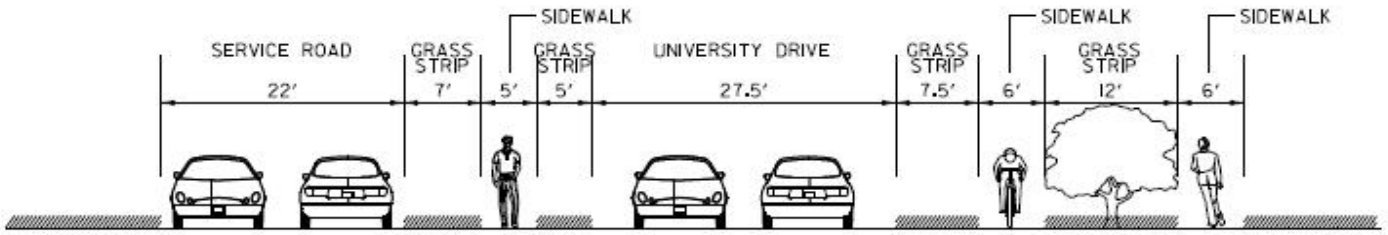
The corridor improvement alternatives were generally described above. Within this section the alternatives are more fully described, illustrated and evaluated.

2.1 ALTERNATIVES DESCRIPTION

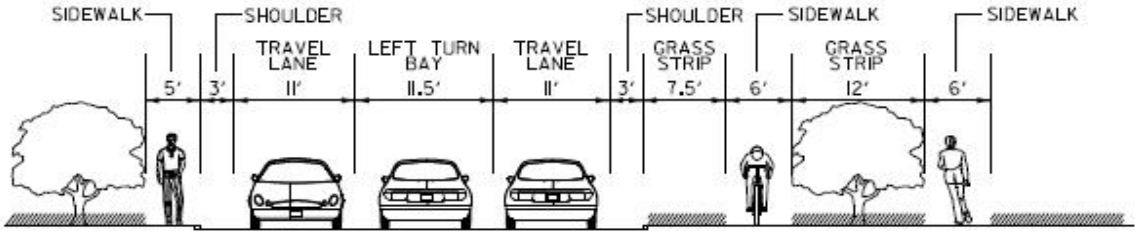
The No Build condition is described and the capacity analysis investigation has been documented in Task 2. The operation of the No Build condition (existing geometry) is referenced throughout the alternatives evaluation. The build alternatives are described below. These descriptions are presented according to the south, middle and north segments because the south segments, adjacent to Route 9, are identical for both alternatives.

Figure 1 offers a cross-sectional view of the two alternatives in comparison with the existing condition. In general, these views demonstrate that the width requirements are less than the existing 98 foot width that extends from the shared use recreational path on the east side to the service road on the west side. The Modified Three Lane Alternative requires a 76 foot width which also incorporates an unchanged shared use path on the eastside and extends to the west. The Boulevard with Median Alternative has a 95-foot width requirement that also incorporates an unchanged shared use path on the east side and nearly extends to far edge of the existing service road.

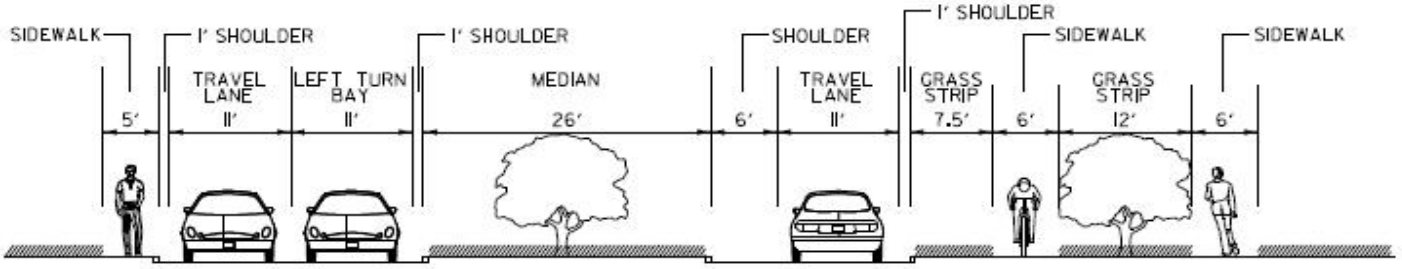
EXISTING GEOMETRY



MODIFIED THREE LANE



BOULEVARD WITH MEDIAN



LOOKING NORTH

FIGURE 1

Amherst Massachussetts

University Drive Improvements

195310230 10/9/2008

Alternative Roadway Cross Sections

Stantec Consulting Services Inc.
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South Burlington, VT U.S.A.
05403
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2.1.1 Modified Three-Lane Alternative

The Modified Three-Lane Alternative for University Drive is so named for the proposed operation of the middle segment of the corridor. Figure 2 illustrates the corridor improvements provided by the Modified Three Lane Alternative.

Through the middle segment, the Modified Three-Lane Alternative will provide for a single through lane in both directions and a center lane which will accommodate a series of successive one-way left turn lanes into driveways on both sides of the corridor. The two-way service road will be eliminated under the Modified Three-Lane Alternative. It presently operates from the Big Y parking lot past all of the west side land use to the Rafters Restaurant's parking lot. Under the Modified Three-Lane Alternative, all of the adjacent properties would have direct access onto University Drive resulting in eight additional access driveway intersections. On the west side of University Drive, the three existing double intersections with University Dive and the immediately adjacent service road would be eliminated at the Big Y, the PO, and the shared driveway serving Athena Pizza.

The Big Y and Extended Care driveways will be signalized as one intersection and coordinated with a modified Route 9 traffic control signal. Geometric improvements include a continuous right turn lane on the southbound roadway from the Big Y Driveway into the existing channelized right turn lane for Route 9. Under existing conditions this lane is effectively shared by right turns and through movements to Snell Street. A second southbound lane will serve through traffic and will also be continuous from the Big Y to Route 9. A protected left turn lane will be constructed within the median.

The north segment involves the Amity Street intersection and retains the traffic signal control. Widening on is proposed to provide left turn lanes on all approaches and an additional through lane on the southbound approach. Due to the two through lanes proposed on the southbound approach, widening to provide two receiving lanes will also be required.

2.1.2 Boulevard with Median Alternative

Similar to the Modified Three-Lane Alternative, the Boulevard with Median Alternative is so named for the proposed operation of the middle segment of the corridor. Figure 2 also illustrates the changes proposed as part of the Boulevard with Median Alternative.

This alternative will supply two eighteen-foot wide directional roadways separated by a median. The northbound roadway will maintain the existing easterly curbline. The southbound roadway will be shifted to the west essentially along the existing service road. The median divided boulevard will include left turn lanes and median breaks for turns into the Post Office / Slobody Building on the west side and all existing eastside properties. Exiting traffic from the Post Office and the Amherst Community Health Center and Center for Extended Care at Amherst will have median breaks for left turn egress. The Boulevard with Median Alternative could also include space within the median for approximately 45 angled parking spaces.

The south segment design is essentially the same between the two alternatives with one exception. In the Modified Three-Lane Alternative, the Extended Care driveway is signalized as part of the Big Y Plaza driveway intersection. In the Boulevard with Median Alternative, this driveway is basically assumed to not be signalized. If deemed necessary, this driveway could be incorporated into the Big Y signalized intersection in the same manner as envisioned in the Modified Three-Lane Alternative.

In the north segment, the signalized Amity Street intersection is replaced with a roundabout. The four approach roadways will remain single lane as would the circulating roadway although the roundabout layout would accommodate a future change. By the year 2029, it is expected that the southbound and westbound approaches would require two lanes and at least part of the circulating roadway would accommodate two lanes.

2.2 ALTERNATIVES EVALUATION

The two described alternatives are versions of earlier alternatives contained in a draft report and publically presented. Based on comments received from abutters and from the Board these alternatives have been modified. In particular the three lane alternative was modified to include better pedestrian crossing features.

The alternatives were then reevaluated and based on the comments received the weighting of the analysis was revised to reflect the greater interest of the abutting land owners for direct driveway access and egress onto University Drive.

The reevaluation is summarized in Table 1 where both of the alternatives are compared to the existing conditions as being better (+), the same (o), or worse (-). The evaluation items are grouped with respect to operational performance, property access, safety, and impacts. The

BOULEVARD WITH MEDIAN

MODIFIED THREE LANE

FIGURE 2
CORRIDOR IMPROVEMENT ALTERNATIVES

UNIVERSITY DRIVE
CORRIDOR IMPROVEMENTS
AMHERST, MA

Stantec

individual comparison items are weighted and all are totaled to demonstrate the overall evaluation. The comparisons are discussed in sections following the table.

Table 1 Alternatives Evaluation

Comparison to Existing	Importance	Modified Three-Lane	Boulevard with Median
	3 Greater; 2 Average; 1 Lesser;	Better; Same; or Worse than Existing (+,o, -)	
Performance			
L O S - Route 9 Intersection	3	+	+
L O S - Big Y Intersection	2	+	+
L O S – Extended Care Driveway	1	+	o(+)*
L O S - Amity Street Intersection	3	+	+
Indirect Travel	2	+	-
Bus Access Westside	2	+	o
Bus Access Eastside	2	+	o
Performance Subtotal	15	+15	+7
Mid Corridor Property Access			
Left Turn Access - Westside	2	+	-
Left Turn Access - Eastside	1	+	o
Left Turn Egress - Westside	1	+	-
Left Turn Egress - Eastside	2	o	-
Truck Left Turn Egress - Westside	1	+	-
Truck Left Turn Egress - Eastside	2	o	-
Truck Right Turn Egress - Westside	2	o	+
Truck Right Turn Egress - Eastside	1	o	+
Property Access Subtotal	12	+5	-5
Safety			
Corridor Conflicts - northbound	2	+	+
Corridor Conflicts - southbound	2	-	+
Pedestrian Crossing-Big Y	3	+	+
Pedestrian Crossing-Mid Corridor	3	+	+
Pedestrian Crossing-Amity St	3	o	+
Bicycle road-sharing northbound	1	+	+
Bicycle road-sharing southbound	1	+	+
Safety Subtotal	15	+8	+15
Impacts			
Property Taking for Right of Way	3	o	-
Easement Taking for Right of Way	3	-	-
Trees Relocated	2	-	-
Trees Eliminated	3	-	o
Parking-Big Y	2	-	-
Parking-Mid Corridor	2	o	+
Aesthetics	3	-	+
Construction Impacts	2	o	-
Impacts Subtotal	20	-13	-7
Evaluation Total	62	+15	+10
Project Costs			
Construction Costs (130% of estimate)		$1.87m	$2.04m
Right of Way		Yes	Yes
Construction Engineering (15%)		$0.28m	$0.31m
Total Project Costs without ROW		**$2.15m**	**$2.35m**

* As shown, no signalized access but an expanded Big Y signal could control this driveway.

2.2.1 LOS

Level of Service (LOS) is a measure of an intersection's operation which is based on the average delay experienced per vehicle. At signalized intersections all vehicles entering the intersection are included in the calculation. Conversely, at unsignalized intersections, only the minor street movements and the left turns from University Drive are included in the analysis. The results indicate the following for the signalized University Drive intersections:

- At Route 9, LOS would be improved under both alternatives.
- At Big Y, LOS would be improved under both alternatives.
- At the Extended Care Drive, LOS would be improved under the Modified Three-Lane Alternative
- At Amity Street, LOS would be improved under both alternatives.

The importance of the LOS has been weighed with respect to the volume of traffic with the terminal intersections greater and the private driveways lesser important.

2.2.2 Indirect Travel

The existing service road and the consolidated access onto University Drive along the west side of the corridor force many vehicles to travel in a direction opposite of their destination. Under both alternatives, this additional (indirect) traveling on the service road will be eliminated as the service road is eliminated; however, the Boulevard with Median Alternative will require some indirect traveling where a right turn and a U-turn are required instead of a left turn.

This indirect travel has been noted with average importance.

2.2.3 Bus Access

Bus Stop facilities are improved over existing conditions under both alternatives. Improved access to buses relates to stop locations, the need for buses to wait for traffic break to pull back into the travel way and the proximity of the crosswalks. Under the Boulevard with Median Alternative, the west side bus stop is located closer to the post office and crosswalks are short but unprotected as they are with the traffic signal control in the Modified Three Lane Alternative.

The evaluation considers the east side and west side separately and associates average importance to this measure.

2.2.4 Direct Left Turn Access within the Middle of the Corridor

Under the Modified Three-Lane Alternative, the elimination of the service road and the combination of individual driveway curb cuts onto University Drive and left turn lanes from

University Drive would facilitate direct left turn access to properties along the middle of the corridor. The Boulevard with Median Alternative would maintain the left turn access to the eastside but not to the Westside mid-corridor properties.

The evaluation considers the west side and east side separately and assigns greater value to access for vehicles from the Route 9 direction.

2.2.5 Mid Corridor Left Turn Egress

Elimination of the service road and addition of separate curb cuts along the west side would facilitate direct egress from the Westside under the Modified Three-Lane Alternative. The Boulevard with Median would generally require right turns and use of U-turn facilities.

- On the Westside, the Modified Three-Lane Alternative would be more accommodating than the existing and the Boulevard with Median Alternative.
- On the Eastside the Modified Three-Lane Alternative would also be more accommodating than the Boulevard with Median Alternative, although under peak conditions, the roundabout might be more effective means to reach Route 9.

Due to the greater demand for left turns toward Route 9, Westside left turn egress is valued less than Eastside.

2.2.6 Truck Left Turn Egress

Larger trucks exiting onto University Drive would be affected by turning radius under the Boulevard Alternative; however, most trucks are destined for Route 9. The absence of the service road would be an improvement.

- On the Westside, from properties north of the Slobody Building, the U-turn facility would not accommodate large trucks.
- On the Eastside, both alternatives would accommodate egress with the Boulevard directing all left turning vehicles to the roundabout.

Comparison importance is lower on Westside than Eastside because Route 9 is likely egress route.

2.2.7 Mid Corridor Truck Right Turn Egress

Again, the absence of the service road would be an improvement. Larger trucks exiting right onto University Drive would be affected by restrictive turning radius affected by the raised median under the Boulevard with Median Alternative and by the narrower single lane roadway and opposing left turn lane under the Three-Lane Alternative.

- On the Westside and Eastside, the Boulevard with Median would have the least restriction on trucks turning right onto University Drive.

Comparison importance is greater on the Westside than Eastside because Route 9 is the likely egress route.

2.2.8 Corridor Conflicts

The existing service road provides an access management function by restricting the number of driveways along University Drive. With the growth of traffic volumes since its construction the service road operation has degraded as all Westside vehicles are directed through consolidated access points onto University Drive and vehicles converge from a greater number of directions within the "double intersections". The Modified Three-Lane Alternative would eliminate the service road and its remaining access management value. The Boulevard would reduce the conflict to vehicles traveling in the same direction by requiring right turns.

Stantec assigned average importance for alternatives' comparisons on both sides.

2.2.9 Pedestrian Crossing

In general the Modified Three-Lane Alternative would provide shorter crosswalks than the existing and the Boulevard with Median Alternative except at the Amity Street intersection. This translates to improved pedestrian crossing.

- At the Big Y, a pedestrian crosswalk would be positioned immediately north of the driveway under the Boulevard with Median Alternative. Under the Modified Three-Lane Alternative, the crosswalk serving this crossing would be north of the Extended Care Driveway.

- At the Extended Care Driveway under the Modified Three-Lane Alternative, the pedestrian crossing would be immediately north of the Driveway and would effectively connect the bus stops. The crossing would be served by a traffic control signal. Under the Boulevard with Median, there would be no crosswalk here but rather at the Big Y and in front of the Post Office.

- At the Post Office, there would be a crosswalk across University Drive under the Boulevard with Median in the vicinity of the bus pull outs located there. Under the Modified Three-Lane Alternative, the crosswalks would be located to the north and south: north of the Slobody Building and north of the Extended Care Driveway.

- At the Newmarket Plaza under both alternatives, a new crosswalk would be located south of the driveway.

- At Amity Street, three crosswalks would be lengthened and the fourth leg would remain without a crosswalk due to the absence of sidewalks on the northwest corner. Under the Boulevard with Median Alternative the crosswalks would be shorter due to the roundabout design.

The highest importance has been assigned to the provision of pedestrian crossings.

2.2.10 Road-Sharing with Bicycles

The Modified Three-Lane alternative widens the roadway to provide a center left turn lane and the edge line would be offset only one foot from the curbed edge of road. That offset or shoulder would not accommodate bicycles within the University Drive travel-way. The Boulevard Alternative would include 6 feet of shoulder divided between the left and right sides and could be apportioned to accommodate bicycles

- On the northbound side, both alternatives would retain the shared use path to the right of the northbound roadway.
- On the southbound side, the Boulevard with Median Alternative would include an 18-foot wide pavement within which drivers could better share the road with bicycles.

Lower importance has been assigned recognizing the eastside shared use path.

2.2.11 Property Taking for Right of Way

From the south egress of the Post Office to Route 9, the proposed improvements and associated right of way requirements are similar under both alternatives. Takings of 5-10' on the west side will be required for construction of sidewalks.

To the north, the Boulevard with Median Alternative would incorporate the existing service road, which is privately owned, as the southbound travel-way and would require takings of 25-30'. The roundabout associated with this alternative would also require substantial greater takings at Amity Street.

The roadways associated with the Modified Three-Lane Alternative would be generally contained within the current roadway layout as this alternative generally abandons the use of the service road. North of the Post Office south egress, takings of approximately 5' would be required for construction of sidewalks. Widening of University Drive approaches to Amity Street would require takings on the west corners of the intersection.

Higher comparative importance is assigned to property takings.

2.2.12 Property Easements for Right of Way

The Modified Three-Lane Alternative will displace the trees along the west side of University Drive and will require easements from the adjacent private property owners in order to transplant them along the west side of the corridor.

The Boulevard Alternative requires an easement from the Post Office to allow Slobody Building exiting traffic to travel through the parking lot and exit via the Post Office exit.

Higher importance is assigned to the comparative need for Property easements.

2.2.13 Trees Relocated

The trees along the Westside of University Drive would be displaced under both alternatives. Potentially, all 45 trees could be transplanted within the Boulevard median under that alternative. Adjacent green areas or service road conversion to green areas would be required for transplanting these trees under the Three-Lane Alternative. Due to the new driveways or adjacent parking areas, approximately 35 of the 45 trees could be relocated under the Modified Three-Lane Alternative.

Average importance is assigned to tree relocation.

2.2.14 Trees Eliminated

Under the Modified Three-Lane Alternative, 10 of the 45 existing trees on the west side will be eliminated.

Higher importance is assigned to tree elimination.

2.2.15 Parking

The Big Y parking Lot would be the single greatest source of lost parking spaces. The same number of parking spaces would be lost in the Big Y parking lot under both alternatives. Essentially, one parking bay from the entrance drive to the landscaped raised medians near the center of the parking lot would be required for the access to the proposed driveway intersection with University Drive. The number of lost spaces would be determined after identifying the optimum layout within the reconfigured parking areas.

Under the Modified Boulevard Alternative, one or two spaces may be lost in the Slobody Building parking area and three spaces lost in the area immediately in front of the Hangar restaurant. Over forty spaces could be gained by incorporating angle parking within the median.

Under the Three-Lane Alternative, reconfiguration of the Post Office parking lot as well as the Athena Restaurant and Hangar Restaurant may add two spaces each where angled parking could be converted to perpendicular parking.

Average importance is assigned to parking space loss and gain.

2.2.16 Aesthetics

Green space can be incorporated in both alternatives. The Boulevard Alternative will include two 18-foot wide roadways separated by a median that is 12 feet wide and can accommodate the 45 transplanted trees from the west side of University Drive. Under the Modified Three-Lane Alternative, the roadway will be 40-feet wide and portions of the existing service road can be landscaped with some of the transplanted trees. The Modified Three-Lane Alternative's greater expanse of pavement and reduced number of transplanted trees would be less aesthetic.

Greater importance is assigned to aesthetics for comparing alternatives.

2.2.17 Construction Impacts

Construction of signalization at the Big Y and Route 9 intersections will be the same for both alternatives. Under the Boulevard with Median Alternative the service road will be converted to the southbound roadway. That work will include creating a new pavement structure while narrowing the overall pavement width from the existing varying width of 20-26 feet to the planned 18 feet. On the northbound roadway, the existing two way roadway which is 24 feet wide will be reduced to 18 feet. The roundabout at Amity Street will be constructed to replace the signalized intersection. The Modified Three-Lane Alternative will expand the existing 24-foot roadway to 40 feet on the west side and will convert portions of the service road to landscaped areas. This alternative will also widen the approaches of three legs into the Amity Street intersection.

Average importance is assigned to construction impacts.

2.2.18 Construction Cost

The construction costs shown are Adjusted Engineer's Opinion of Cost. They are based on the Engineer's Opinion of Cost for the conceptual designs (2007 values) with a 30% contingency added for unidentified or adjusted scope. The 30% contingency is added due to the limited specifics associated with the conceptual designs. The Modified Three-Lane Alternative has an estimated cost of $2.15 million and the Boulevard Alternative at $2.35 million.

3.0 Conclusion

Two Alternatives have evolved from numerous improvement measures considered for the University Drive corridor. One of these two, the Modified Three Lane Alternative, is more responsive to the interests and needs of the corridor property owners who offered comments during the fall of 2007. This final report presents the comparison of the Modified Three Lane Alternative and the Median with Boulevard Alternative based on capacity performance, property access, safety, impacts and conceptual construction cost estimates. The Alternatives evaluation concisely demonstrates this comparison indicating where one alternative outperforms the other in improving existing corridor conditions and why the Modified Three Lane Alternative is the preferred corridor improvement plan.

4.0 Appendix

2029 Traffic Volume Networks

Analysis Summaries

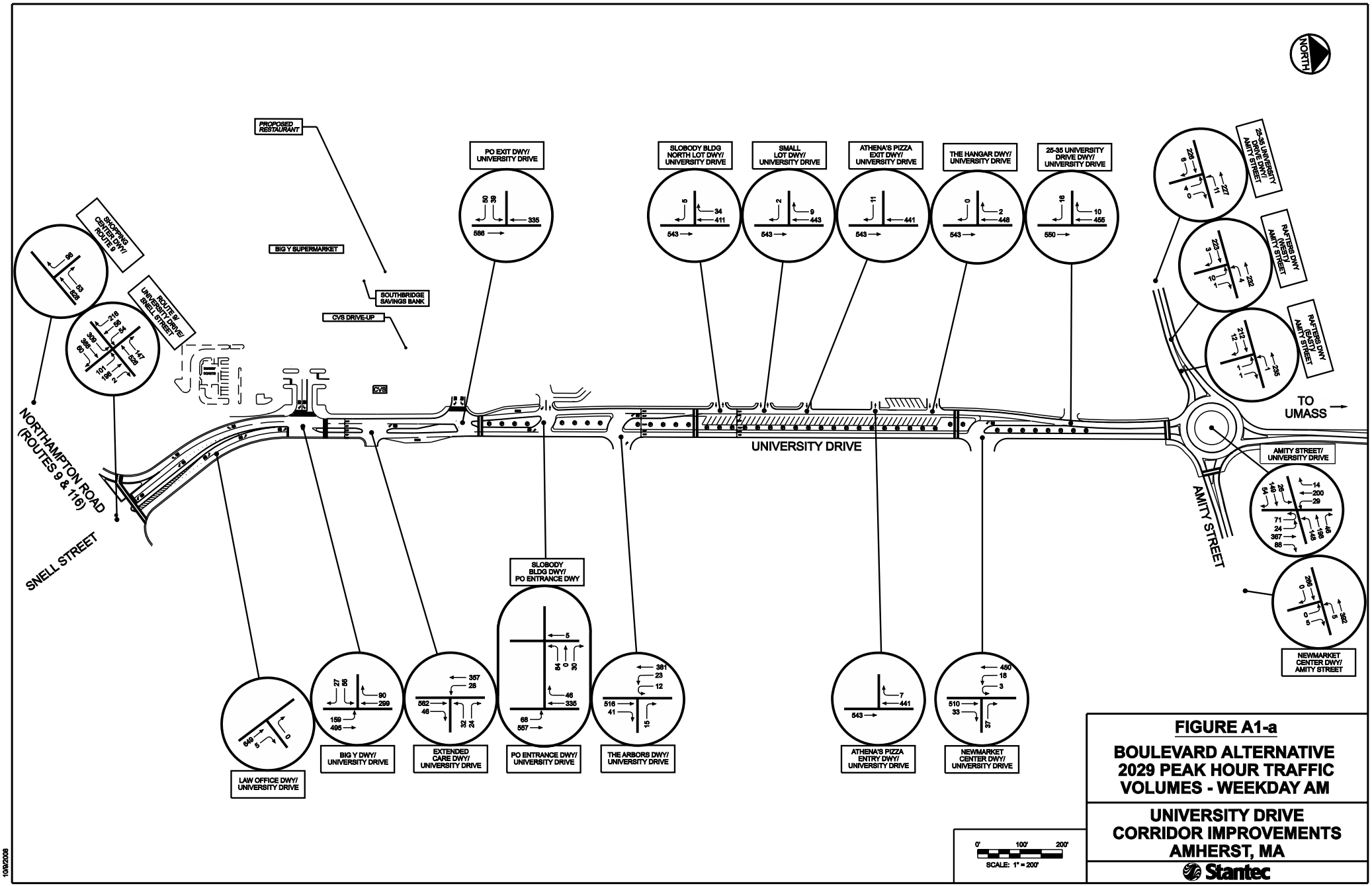

FIGURE A1-a

BOULEVARD ALTERNATIVE 2029 PEAK HOUR TRAFFIC VOLUMES - WEEKDAY AM

UNIVERSITY DRIVE CORRIDOR IMPROVEMENTS AMHERST, MA

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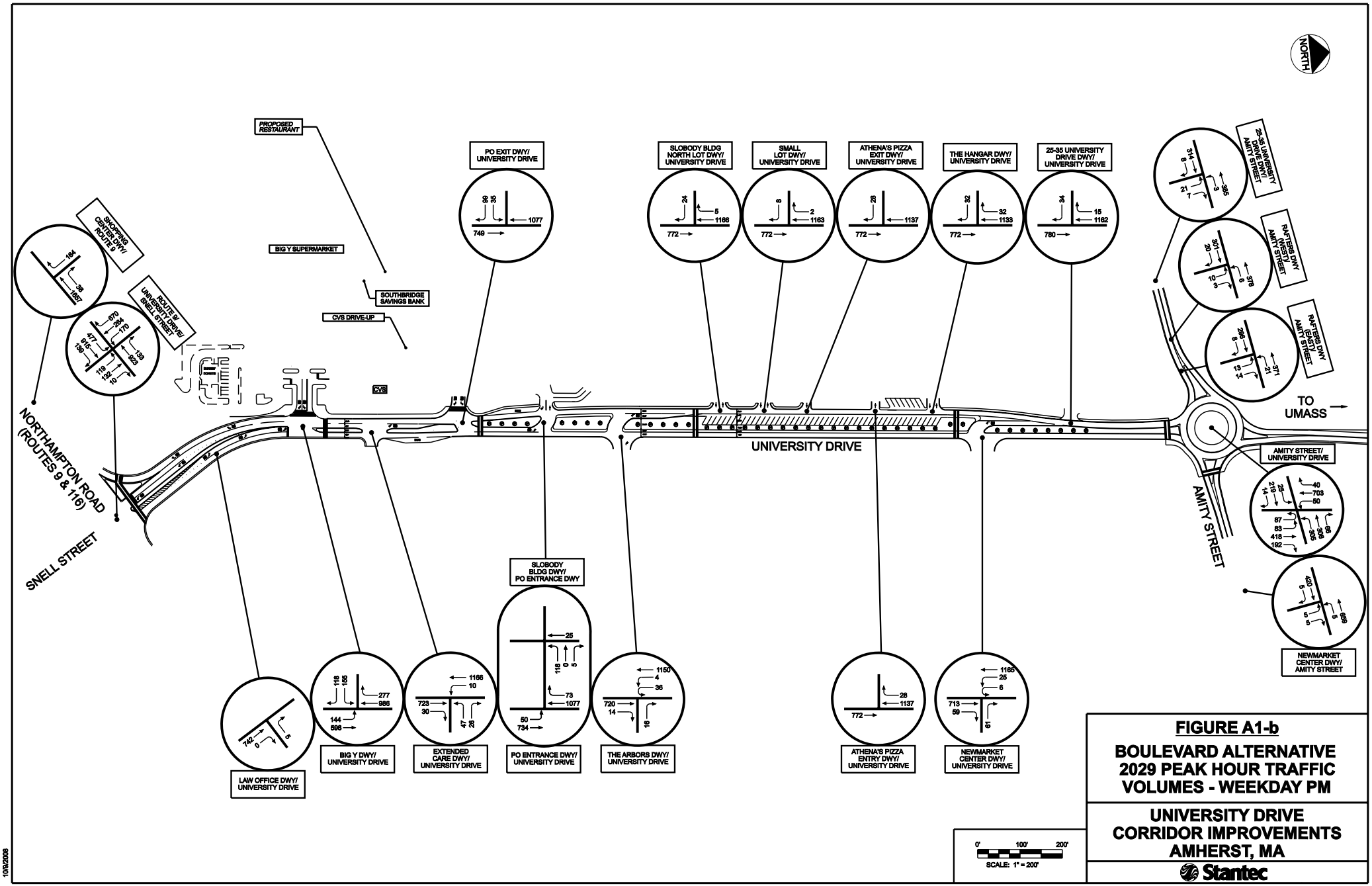

FIGURE A1-b

BOULEVARD ALTERNATIVE 2029 PEAK HOUR TRAFFIC VOLUMES - WEEKDAY PM

UNIVERSITY DRIVE CORRIDOR IMPROVEMENTS AMHERST, MA

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10/9/2009

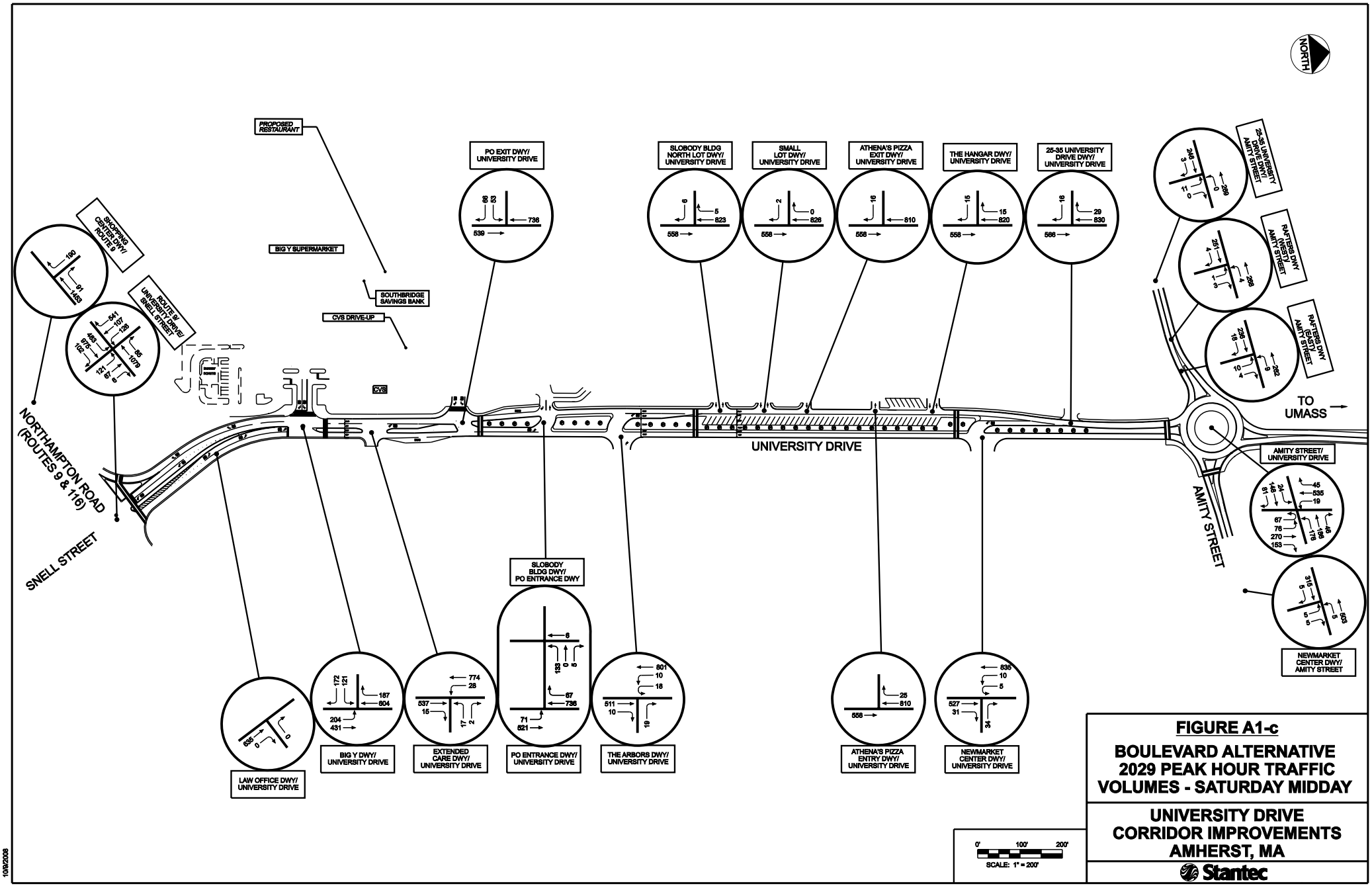

FIGURE A1-c

BOULEVARD ALTERNATIVE 2029 PEAK HOUR TRAFFIC VOLUMES - SATURDAY MIDDAY

UNIVERSITY DRIVE CORRIDOR IMPROVEMENTS AMHERST, MA

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10/9/2009

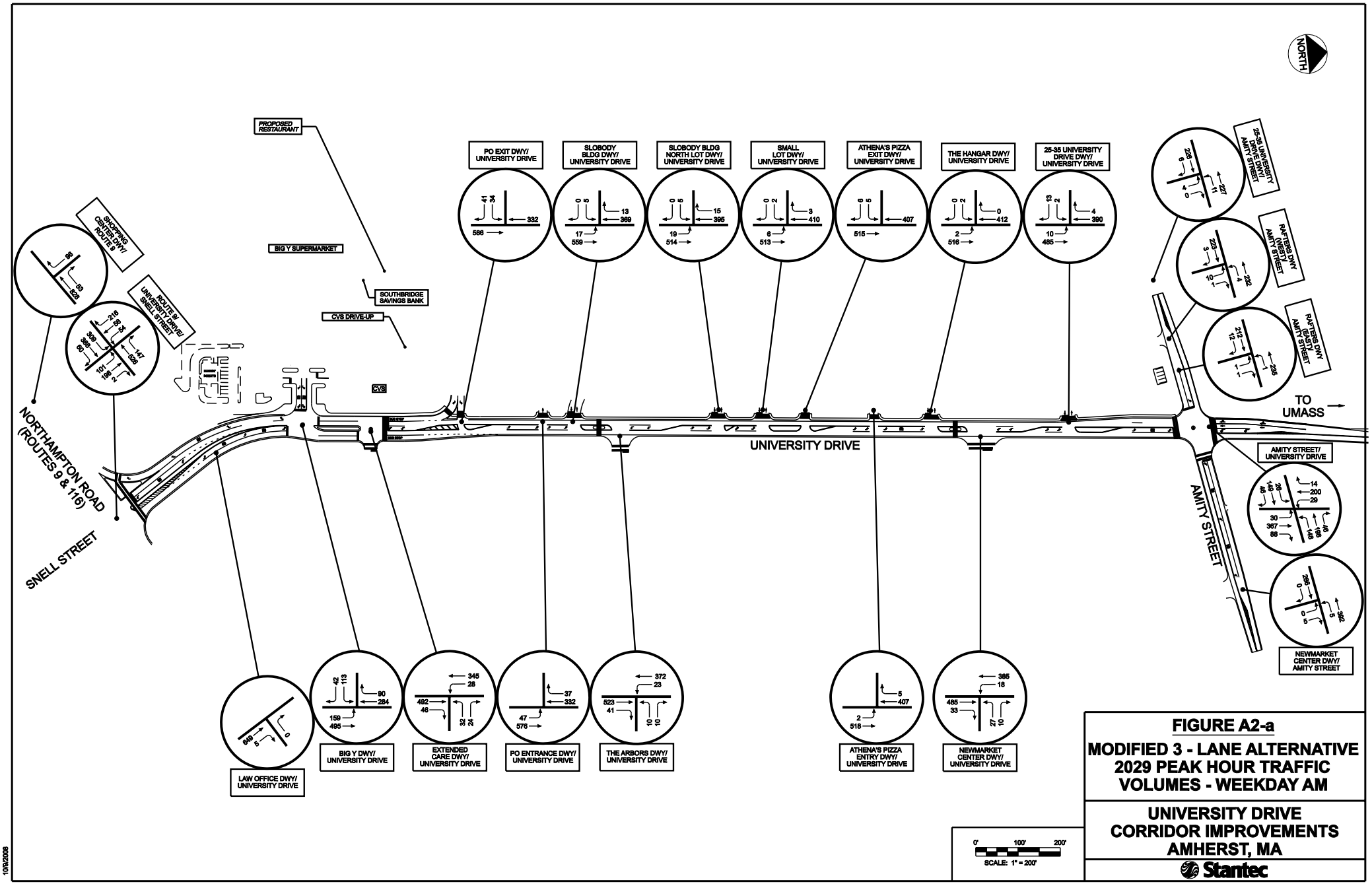

FIGURE A2-a

MODIFIED 3 - LANE ALTERNATIVE 2029 PEAK HOUR TRAFFIC VOLUMES - WEEKDAY AM

UNIVERSITY DRIVE CORRIDOR IMPROVEMENTS AMHERST, MA

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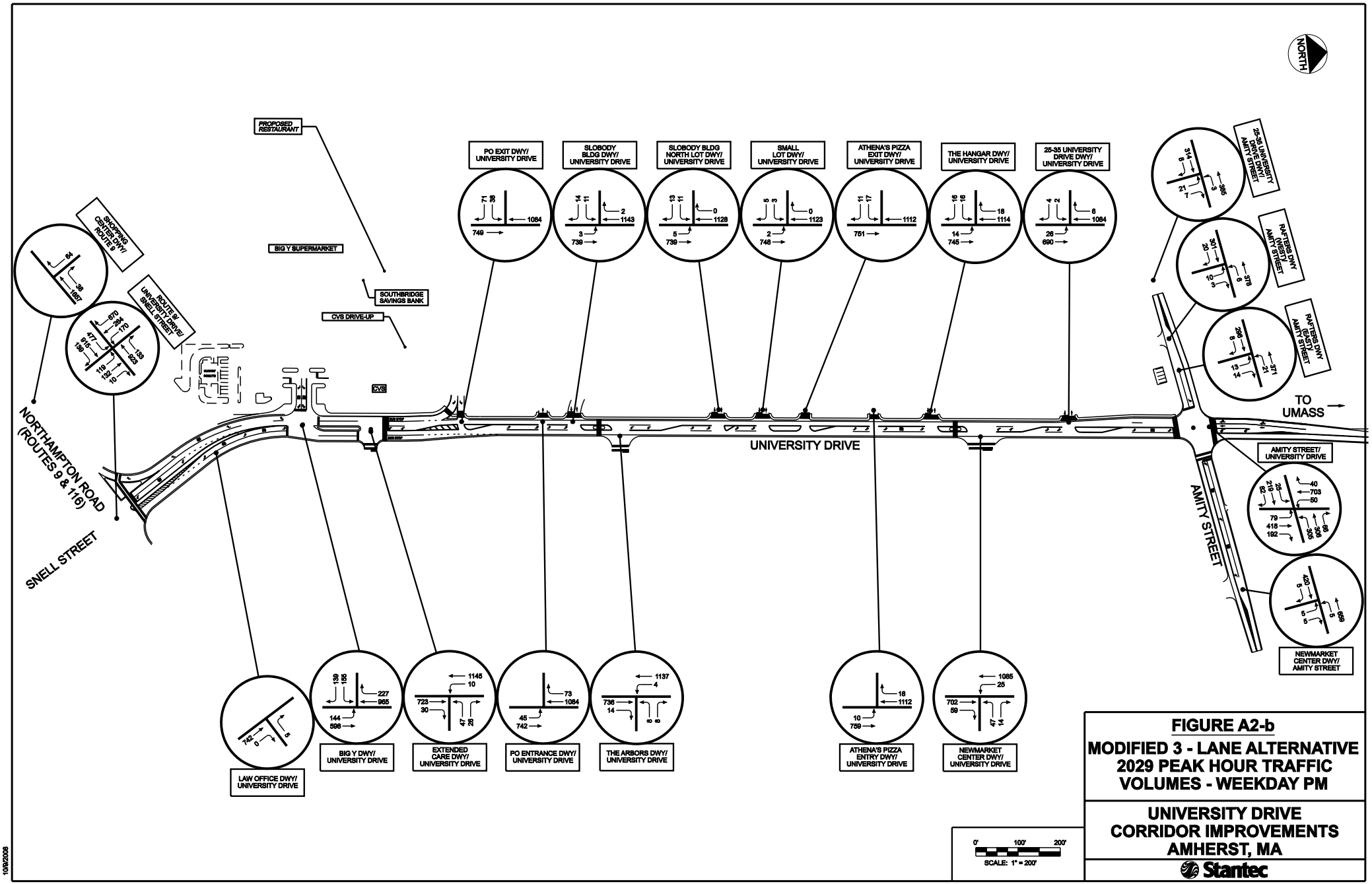

FIGURE A2-b

MODIFIED 3 - LANE ALTERNATIVE 2029 PEAK HOUR TRAFFIC VOLUMES - WEEKDAY PM

UNIVERSITY DRIVE CORRIDOR IMPROVEMENTS AMHERST, MA

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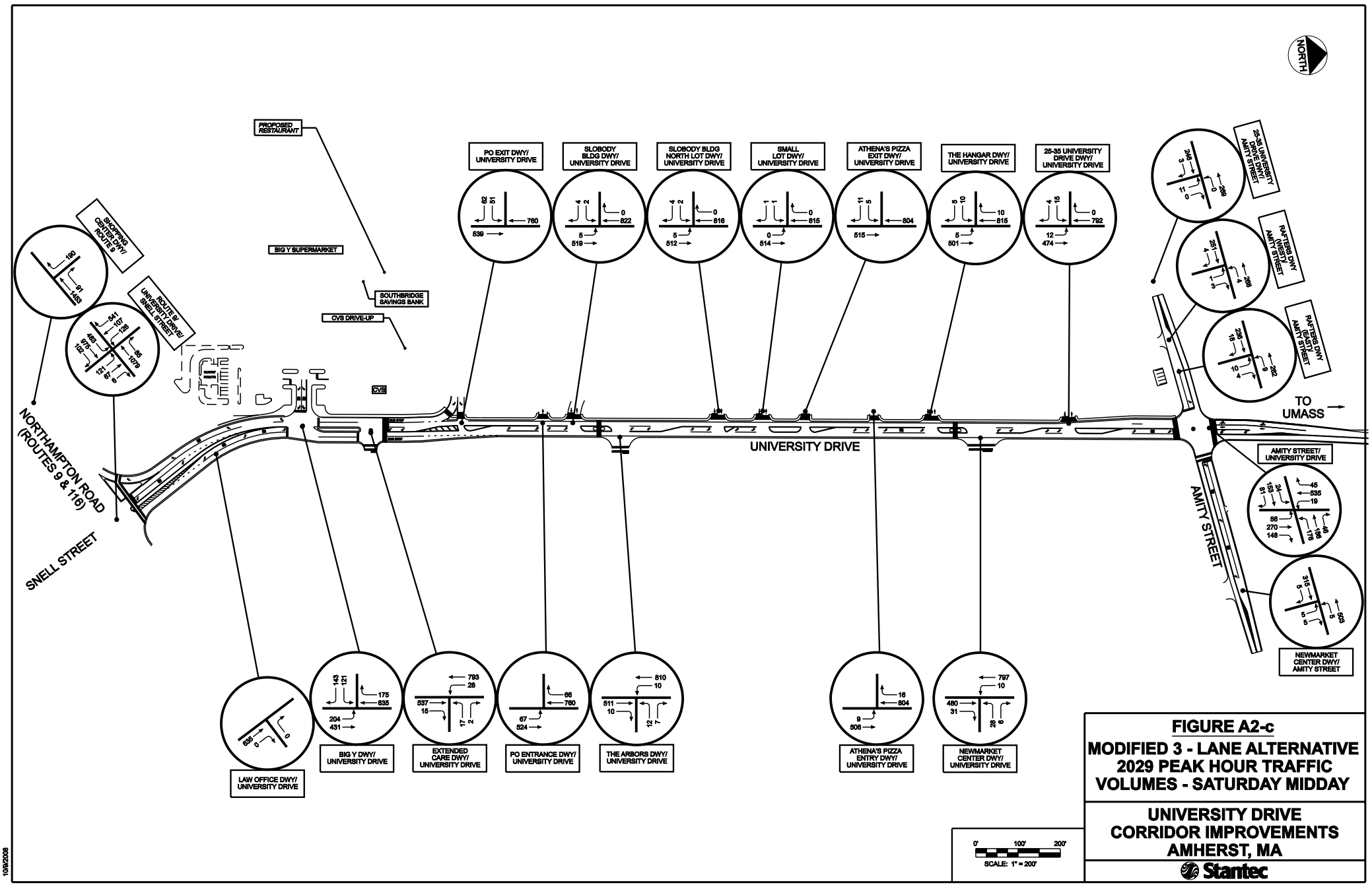

FIGURE A2-c

MODIFIED 3 - LANE ALTERNATIVE 2029 PEAK HOUR TRAFFIC VOLUMES - SATURDAY MIDDAY

UNIVERSITY DRIVE CORRIDOR IMPROVEMENTS AMHERST, MA

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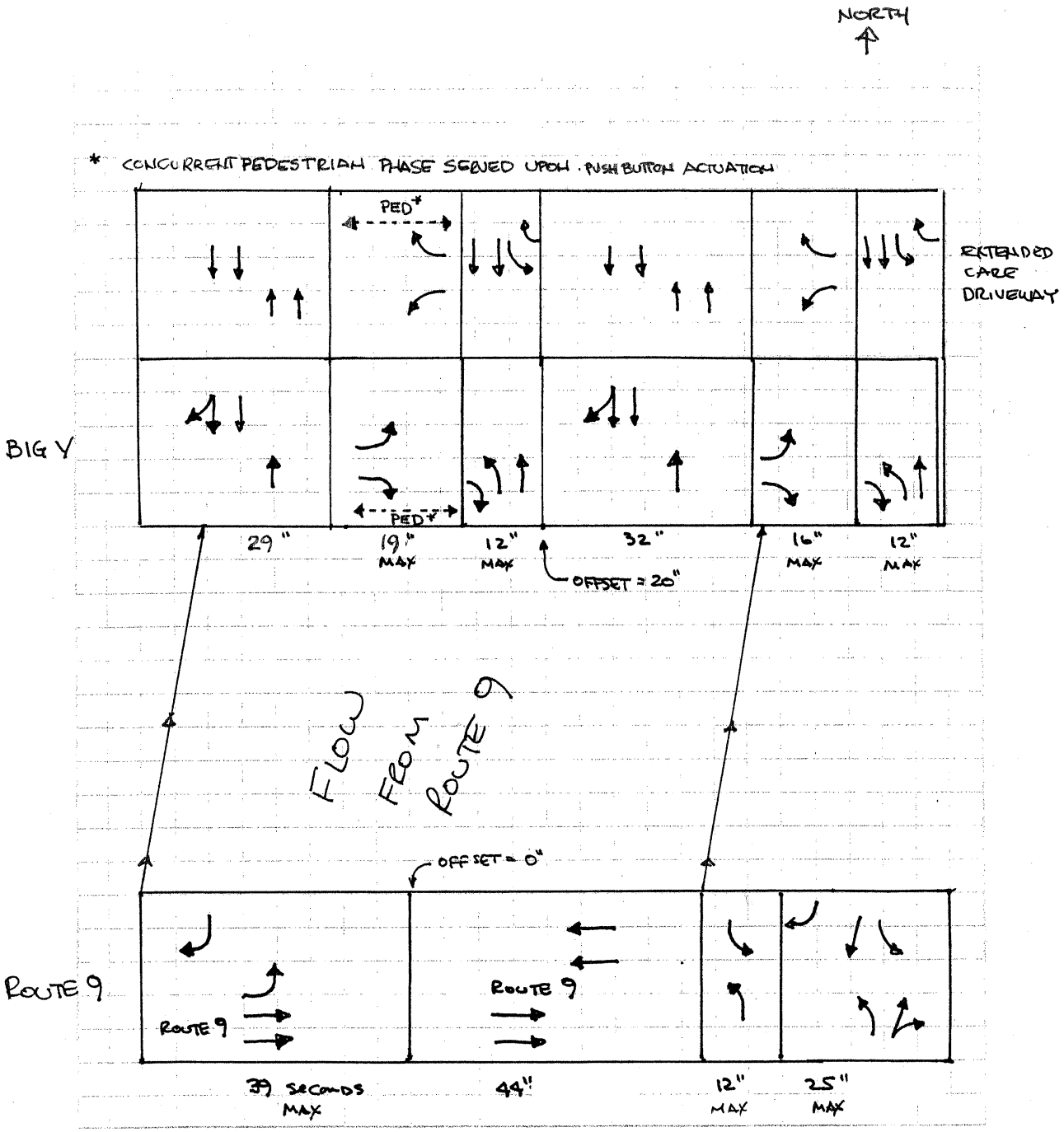

Figure A3

Amherst Massachussetts **University Drive Corridor Improvement Study** 192500230 11/20/2008	**Univesity Drive at Route 9, Big Y / Extended Care Driveway Traffic Signal Phasing**	**Stantec Consulting Services Inc.** 136 West St., Suite 203 Northampton, MA U.S.A. 01060 Tel. 413.584.4776 Fax. 413.584.3157 www.stantec.com

Route 9 at University Drive

Existing Geometry and Volumes

Existing Geometry and Signal Phasing		University Drive Southbound			Snell Street Northbound			Route 9 Eastbound			Route 9 Westbound			OVERALL HCM LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	
Weekday AM	V/C Ratio	0.10	0.13	0.52		0.86	0.67		0.22	0.70		0.42		C
	HCM LOS	C	D	D		E	D		B	D		C		
	95% Queue (v)	1	2	2		8	6		4	8		8		
Weekday PM	V/C Ratio	0.7	0.67	2.09		0.63	0.93		0.43	0.88		0.92		E
	HCM LOS	C	D	F		D	F		B	E		D		
	95% Queue (v)	8	8	9		6	8		9	16		16		
Saturday MID	V/C Ratio	0.43	0.22	1.29		0.29	0.69		0.43	0.84		0.84		D
	HCM LOS	B	C	F		D	E		B	D		D		
	95% Queue (v)	5	4	7		3	6		8	16		14		

Existing Geometry and 2029 Volumes

Existing Geometry and Signal Phasing		University Drive Southbound			Snell Street Northbound			Route 9 Eastbound			Route 9 Westbound			OVERALL HCM LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	
Weekday AM	V/C Ratio	0.22	0.15	0.99		1.14	0.74		0.26	0.89		0.76		D
	HCM LOS	B	D	F		F	E		B	E		D		
	95% Queue (v)	2	3	5		12	6		5	14		13		
Weekday PM	V/C Ratio	1.04	0.91	3.52		0.75	1.08		0.61	1.27		1.33		F
	HCM LOS	E	E	F		E	F		B	F		F		
	95% Queue (v)	25	11	14		8	9		14	27		27		
Saturday MID	V/C Ratio	0.73	0.31	2.17		0.37	0.81		0.63	1.22		1.27		F
	HCM LOS	C	D	F		D	E		B	F		F		
	95% Queue (v)	11	5	11		4	8		14	26		29		

Modified Three Lane Alternative Improvement

Proposed Geometry and Signal Phasing		University Drive Southbound			Snell Street Northbound			Route 9 Eastbound			Route 9 Westbound			OVERALL HCM LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	
Weekday AM	V/C Ratio	0.20	0.21	0.30		0.70	0.36		0.20	0.82		0.52		C
	HCM LOS	D	D	C		D	D		A	E		C		
	95% Queue (v)	3	4	3		9	5		4	13		13		
Weekday PM	V/C Ratio	0.95	0.84	0.79		0.59	0.69		0.5	1.02		1.02		D
	HCM LOS	D	E	D		D	E		B	F		E		
	95% Queue (v)	21	15	9		7	7		11	25		24		
Saturday MID	V/C Ratio	0.74	0.51	0.5		50	0.66		0.47	0.98		0.99		D
	HCM LOS	C	E	D		E	E		A	E		E		
	95% Queue (v)	13	6	7		4	6		10	25		26		

Boulevard with Median Alternative Improvement

Proposed Geometry and Signal Phasing		University Drive Southbound			Snell Street Northbound			Route 9 Eastbound			Route 9 Westbound			OVERALL HCM LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	
Weekday AM	V/C Ratio	0.20	0.21	0.30		0.70	0.36		0.20	0.82		0.52		C
	HCM LOS	C	D	D		D	D		A	E		C		
	95% Queue (v)	4	4	4		10	5		4	13		13		
Weekday PM	V/C Ratio	0.86	0.89	0.66		0.53	0.78		0.5	0.99		1.02		D
	HCM LOS	C	E	D		D	E		B	F		E		
	95% Queue (v)	28	15	4		7	6		11	25		25		
Saturday MID	V/C Ratio	0.73	0.47	0.48		0.5	0.66		0.47	0.98		1.02		D
	HCM LOS	C	D	D		E	E		B	E		E		
	95% Queue (v)	14	6	7		4	6		9	25		26		

Figure A4

Amherst Massachussetts

University Drive
Corridor Improvement Study

192500230 10/7/2008

Route 9 at University Drive
Capacity Analysis Summary

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Big Y at University Drive

Existing Geometry and Volumes

Existing Geometry and Signal Phasing		University Drive Southbound			University Drive Northbound			Big Y Entrance/Exit Eastbound						Critical Minor St LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left				
Weekday AM	V/C Ratio		0.15			0.24	0.08	0.07		0.19				C
	HCM LOS		-			-	A	A		C				
	95% Queue (v)		0			0	1	1		1				
Weekday PM	V/C Ratio		0.54			0.27	0.21	0.39		1.08				F
	HCM LOS		-			-	B	C		F				
	95% Queue (v)		0			0	1	2		7				
Saturday MID	V/C Ratio		0.34			0.18	0.19	0.23		0.46				E
	HCM LOS		-			-	A	B		E				
	95% Queue (v)		0			0	1	1		2				

Existing Geometry and 2029 Volumes

Existing Geometry and Signal Phasing		University Drive Southbound			University Drive Northbound			Big Y Entrance/Exit Eastbound						Critical Minor St LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left				
Weekday AM	V/C Ratio		0.20			0.30	0.14	0.12		0.59				E
	HCM LOS		-			-	A	B		E				
	95% Queue (v)		0			0	1	1		3				
Weekday PM	V/C Ratio	0.31	0.38			0.35	0.32	0.42		3.32				F
	HCM LOS	-	-			-	B	C		F				
	95% Queue (v)	0	0			0	2	2		NC*				
Saturday MID	V/C Ratio		0.46			0.26	0.28	0.44		1.2				F
	HCM LOS		-			-	B	C		F				
	95% Queue (v)		0			0	1	2		7				

Modified Three Lane Alternative Improvement (with traffic signal control)

Proposed Geometry and Signal Phasing		University Drive Southbound			University Drive Northbound			Big Y Entrance/Exit Eastbound						OVERALL HCM LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left				
Weekday AM	V/C Ratio		0.20			0.41	0.27	0.03		0.54				A
	HCM LOS		A			A	A	B		C				
	95% Queue (v)		2			10	3	1		3				
Weekday PM	V/C Ratio		0.75			0.5	0.5	0.22		0.7				B
	HCM LOS		B			A	B	B		C				
	95% Queue (v)		11			9	3	2		4				
Saturday MID	V/C Ratio		0.49			0.36	0.5	0.1		0.57				B
	HCM LOS		B			A	B	B		C				
	95% Queue (v)		8			8	4	2		4				

Boulevard with Median Alternative Improvement (with traffic signal control)

Proposed Geometry and Signal Phasing		University Drive Southbound			University Drive Northbound			Big Y Entrance/Exit Eastbound						OVERALL HCM LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left				
Weekday AM	V/C Ratio		0.21			0.39	0.25	0.02		0.39				A
	HCM LOS		A			A	A	C		C				
	95% Queue (v)		1			5	2	1		2				
Weekday PM	V/C Ratio		0.53			0.49	0.71	0.1		0.54				A
	HCM LOS		A			A	A	B		C				
	95% Queue (v)		3			9	3	1		2				
Saturday MID	V/C Ratio		0.69			0.48	0.57	0.17		0.7				B
	HCM LOS		B			A	C	B		C				
	95% Queue (v)		4			5	5	2		4				

NC* = Not Calculable (very long)

Figure A5

Amherst Massachussetts

University Drive Corridor Improvement Study

195310230 10/8/2008

Big Y at University Drive Capacity Analysis Summary

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Extended Care Driveway at University Drive

Existing Geometry and Volumes

Existing Geometry		University Drive Southbound			University Drive Northbound			Extended Care Driveway Westbound						Critical Minor St LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left				
Weekday AM	V/C Ratio		0.03			0.27			0.13					B
	HCM LOS		A			-			B					
	95% Queue (v)		1			0			1					
Weekday PM	V/C Ratio		0.01			0.3			0.39					D
	HCM LOS		A			-			D					
	95% Queue (v)		1			0			2					
Saturday MID	V/C Ratio		0.03			0.23			0.07					C
	HCM LOS		A			-			C					
	95% Queue (v)		1			0			1					

Existing Geometry and 2029 Volumes

Existing Geometry		University Drive Southbound			University Drive Northbound			Extended Care Driveway Westbound						Critical Minor St LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left				
Weekday AM	V/C Ratio		0.03			0.36			0.16					C
	HCM LOS		A			-			C					
	95% Queue (v)		1			0			1					
Weekday PM	V/C Ratio		0.01			0.39			0.62					F
	HCM LOS		A			-			F					
	95% Queue (v)		1			0			3					
Saturday MID	V/C Ratio		0.03			0.31			0.11					D
	HCM LOS		A			-			D					
	95% Queue (v)		1			0			1					

Modified Three Lane Alternative Improvement (with traffic signal control)

Proposed Geometry and Signal Phasing		University Drive Southbound			University Drive Northbound			Extended Care Driveway Westbound						OVERALL HCM LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left				
Weekday AM	V/C Ratio		0.14	0.05		0.27		0.02		0.26				A
	HCM LOS		A	A		A		C		C				
	95% Queue (v)		2	1		4		1		2				
Weekday PM	V/C Ratio		0.47	0.03		0.37		0.02		0.34				A
	HCM LOS		A	A		A		C		C				
	95% Queue (v)		6	1		6		1		2				
Saturday MID	V/C Ratio		0.3	0.05		0.26		0		0.4				A
	HCM LOS		A	A		A		C		C				
	95% Queue (v)		3	1		4		1		1				

Boulevard with Median Alternative Improvement

Proposed Geometry		University Drive Southbound			University Drive Northbound			Extended Care Driveway Westbound						Critical Minor St LOS
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left				
Weekday AM	V/C Ratio		0.22	0.03		0.38			0.19					C*
	HCM LOS		-	A		-			C					
	95% Queue (v)		0	1		0			1					
Weekday PM	V/C Ratio		0.72	0.01		0.47			1.15					F*
	HCM LOS		-	A		-			F					
	95% Queue (v)		0	1		0			6					
Saturday MID	V/C Ratio		0.48	0.03		0.34			0.15					E*
	HCM LOS		-	A		-			E					
	95% Queue (v)		0	1		0			1					

* Note that the Extended Care Driveway could also be served by expansion of the Big Y signalized intersection under this alternative.

Figure A6

Amherst Massachussetts

University Drive Corridor Improvement Study

195310230 10/8/2008

Extended Care Driveway at University Drive Capacity Analysis Summary

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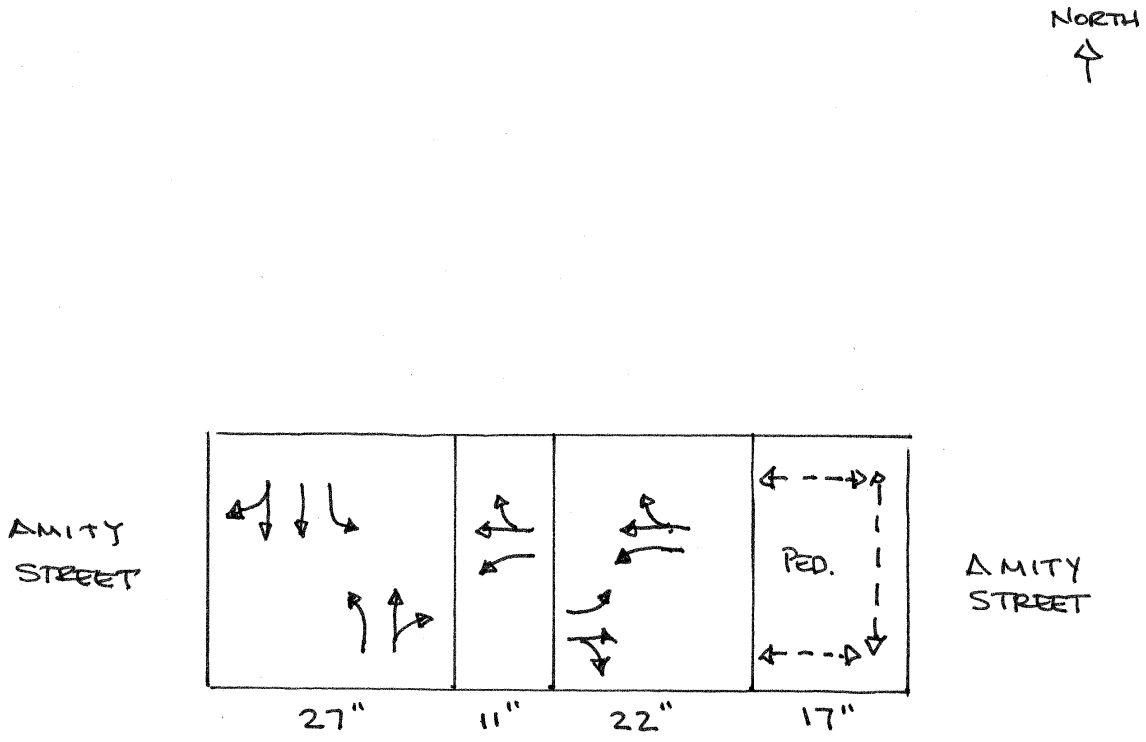

Figure A7

Amherst Massachusetts **University Drive Corridor Improvement Study** 192500230 11/20/2008	**University Drive at Amity Street Traffic Signal Phasing**	**Stantec Consulting Services Inc.** 136 West St., Suite 203 Northampton, MA U.S.A. 01060 Tel. 413.584.4776 Fax. 413.584.3157 www.stantec.com

Amity Street at University Drive

Existing Geometry and Volumes

Existing Geometry and Signal Phasing		University Drive Southbound			University Drive Northbound			Amity Street Eastbound			Amity Street Westbound			
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	OVERALL HCM LOS
Weekday AM	V/C Ratio		0.29			0.61			0.44			0.23		B
	HCM LOS		B			B			A			A		
	95% Queue (v)		4			9			6			3		
Weekday PM	V/C Ratio		0.94			0.66			0.90			0.34		C
	HCM LOS		D			C			C			B		
	95% Queue (v)		41			11			26			5		
Saturday MID	V/C Ratio		0.68			0.61			0.54			0.23		B
	HCM LOS		C			C			A			A		
	95% Queue (v)		9			8			9			4		

Existing Geometry and 2029 Volumes

Existing Geometry and Signal Phasing		University Drive Southbound			University Drive Northbound			Amity Street Eastbound			Amity Street Westbound			
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	OVERALL HCM LOS
Weekday AM	V/C Ratio		0.42			0.80			0.64			0.54		B
	HCM LOS		B			C			B			B		
	95% Queue (v)		6			13			9			11		
Weekday PM	V/C Ratio		1.52			1.23			1.04			0.36		F
	HCM LOS		F			F			E			B		
	95% Queue (v)		33			24			24			6		
Saturday MID	V/C Ratio		0.81			0.85			0.6			0.29		C
	HCM LOS		C			C			B			B		
	95% Queue (v)		13			14			10			5		

Modified Three Lane Alternative Improvement

Proposed Geometry and Signal Phasing		University Drive Southbound			University Drive Northbound			Amity Street Eastbound			Amity Street Westbound			
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	OVERALL HCM LOS
Weekday AM	V/C Ratio		0.13	0.09		0.55	0.06		0.66	0.15		0.43	0.58	B
	HCM LOS		A	A		B	A		C	C		B	B	
	95% Queue (v)		2	1		8	1		6	1		5	3	
Weekday PM	V/C Ratio		0.62	0.42		0.97	0.45		0.72	0.12		0.5	0.97	C
	HCM LOS		B	C		D	C		C	B		B	E	
	95% Queue (v)		7	2		13	3		7	1		6	8	
Saturday MID	V/C Ratio		0.43	0.07		0.58	0.20		0.59	0.11		0.35	0.60	B
	HCM LOS		B	B		B	B		C	B		B	B	
	95% Queue (v)		5	1		8	2		5	1		4	3	

Boulevard with Median Alternative Improvement (single lane roundabout)

Proposed Geometry		University Drive Southbound			University Drive Northbound			Amity Street Eastbound			Amity Street Westbound			
		Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	Rt	Thru	Left	critical Approach v/c
Weekday AM	V/C Ratio	0.26			0.45			0.22			0.43			A
	HCM LOS	A			A			A			A			
	95% Queue (v)	2			4			2			4			
Weekday PM	V/C Ratio	1.29			0.7			0.46			0.88			E
	HCM LOS	F			A			B			C			
	95% Queue (v)	80			18			5			20			
Saturday MID	V/C Ratio	0.67			0.46			0.37			0.43			B
	HCM LOS	B			A			A			A			
	95% Queue (v)	9			5			4			4			

Note : During PM peak hour a 1.29 v/c ratio on the southbound approach indicates need for an additional lane on that approach and part of the existing roadway. With a second SB and WB lane and a second circulating lane (east to south) LOS B is indicated.

Figure A8

Amherst Massachussetts

University Drive Corridor Improvement Study

195310230 10/8/2008

Amity Street at University Drive Capacity Analysis Summary

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Existing Geometry and Volumes Capacity Analysis Summary

Existing Geometry and Signal Phasing		East Side			West Side						
		Law Office	Arbors	New Market Center	Post Office	Slobody	Slobody North Lot	Small Lot	Athena's Pizza	Hangar	# 25-35
Weekday AM	HCM LOS		B	C					B		
	95% Queue (v)		1	6					2		
Weekday PM	HCM LOS		D	F					F		
	95% Queue (v)		5	59					47		
Weekend SAT	HCM LOS		C	C					C		
	95% Queue (v)		2	10					4		

Existing Geometry and 2029 Volumes Capacity Analysis Summary

Existing Geometry and Signal Phasing		East Side			West Side						
		Law Office	Arbors	New Market Center	Post Office	Slobody	Slobody North Lot	Small Lot	Athena's Pizza	Hangar	# 25-35
Weekday AM	HCM LOS		C	C					C		
	95% Queue (v)		3	8					3		
Weekday PM	HCM LOS		F	F					F		
	95% Queue (v)		8	113					103		
Weekend SAT	HCM LOS		D	D					D		
	95% Queue (v)		6	19					8		

Modified Three Lane Alternative Improvement with 2029 Volumes

Proposed Geometry and Signal Phasing		East Side			West Side						
		Law Office	Arbors	New Market Center	Post Office	Slobody	Slobody North Lot	Small Lot	Athena's Pizza	Hangar	# 25-35
Weekday AM	HCM LOS	-	B	B	C	B	B	B	B	B	B
	95% Queue (v)	-	3	6	1	1	1	0	2	0	2
Weekday PM	HCM LOS	-	C	D	F	C	C	C	D	D	C
	95% Queue (v)	-	5	31	3	10	9	3	13	16	2
Weekend SAT	HCM LOS	-	B	C	E	C	C	C	C	C	C
	95% Queue (v)	-	4	8	2	1	1	0	4	4	4

Boulevard and Median Alternative with 2029 Volumes

Proposed Geometry and Signal Phasing		East Side			West Side						
		Law Office	Arbors	New Market Center	Post Office	Slobody	Slobody North Lot	Small Lot	Athena's Pizza	Hangar	# 25-35
Weekday AM	HCM LOS	-	-	-	C	-	-	-	-	-	-
	95% Queue (v)	-	-	-	1	-	-	-	-	-	-
Weekday PM	HCM LOS	-	-	-	F	-	-	-	-	-	-
	95% Queue (v)	-	-	-	3	-	-	-	-	-	-
Weekend SAT	HCM LOS	-	-	-	E	-	-	-	-	-	-
	95% Queue (v)	-	-	-	2	-	-	-	-	-	-

Figure A9

Amherst Massachussetts

University Drive Corridor Improvement Study

195310230 11/24/2008

Left Turn Egress Onto University Drive Capacity Analysis Summary

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Existing Geometry and Volumes Capacity Analysis Summary

Existing Geometry and Signal Phasing		East Side			West Side						
		Law Office	Arbors	New Market Center	Post Office Entrance	Slobody	Slobody North Lot	Small Lot	Athena's Pizza	Hangar	# 25-35
Weekday AM	HCM LOS	A	A	A	A				A		
	95% Queue (v)	0	1	1	2				1		
Weekday PM	HCM LOS	A	A	A	A				A		
	95% Queue (v)	0	0	2	6				3		
Weekend SAT	HCM LOS	A	A	A	A				A		
	95% Queue (v)	0	1	1	4				1		

Existing Geometry and 2029 Volumes Capacity Analysis Summary

Existing Geometry and Signal Phasing		East Side			West Side						
		Law Office	Arbors	New Market Center	Post Office Entrance	Slobody	Slobody North Lot	Small Lot	Athena's Pizza	Hangar	# 25-35
Weekday AM	HCM LOS	A	A	A	A				A		
	95% Queue (v)	0	2	1	14				1		
Weekday PM	HCM LOS	A	A	A	A				A		
	95% Queue (v)	0	0	2	6				4		
Weekend SAT	HCM LOS	A	A	A	A				A		
	95% Queue (v)	0	1	1	5				1		

Modified Three Lane Alternative Improvement with 2029 Volumes

Proposed Geometry and Signal Phasing		East Side			West Side						
		Law Office	Arbors	New Market Center	Post Office Entrance	Slobody	Slobody North Lot	Small Lot	Athena's Pizza	Hangar	# 25-35
Weekday AM	HCM LOS		A	A	A	A	A	A	A	A	A
	95% Queue (v)		2	1	3	1	1	0	0	0	1
Weekday PM	HCM LOS		A	A	B	B	B	B	A	B	B
	95% Queue (v)		0	2	7	0	1	0	2	3	5
Weekend SAT	HCM LOS		A	A	B	A	A	A	B	B	B
	95% Queue (v)		1	1	7	1	1	0	1	1	1

Boulevard and Median Alternative with 2029 Volumes

Proposed Geometry and Signal Phasing		East Side			West Side						
		Law Office	Arbors	New Market Center	Post Office Entrance	Slobody	Slobody North Lot	Small Lot	Athena's Pizza	Hangar	# 25-35
Weekday AM	HCM LOS		A	A	A						
	95% Queue (v)		2	1	5						
Weekday PM	HCM LOS		A	A	A						
	95% Queue (v)		0	2	5						
Weekend SAT	HCM LOS		A	A	A						
	95% Queue (v)		1	1	8						

Figure A10

Amherst Massachusetts

University Drive Corridor Improvement Study

195310230 11/24/2008

Left Turn Access Off University Drive Capacity Analysis Summary

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